

MicroStep -MIS

Your friends in every weather

VIBRATING CYLINDER



COMPARISON WITH SILICONE MEMBRANE

MICROSTEP-MIS CALIBRATION LABORATORY

To achieve the most accurate and professional measurement, it is necessary to employ a regular calibration and adjustment of the meteorological sensors.

MicroStep- MIS offers a comprehensive solution for calibration laboratory including:

- laboratory equipment and standards for the required quantity;
- validated calibration method;
- automation of calibration;
- staff training;
- preparation for accreditation and assistance during the accreditation process.



MICROSTEP-MIS CALIBRATION LABORATORY

We provide services of accredited calibration laboratory. Our laboratory has been accredited according to standard **ISO / IEC 17025: 2005** since February 2017.

Scope of accreditation:

- absolute pressure;
- temperature;
- relative humidity, dew point;
- tipping bucket rain gauges;
- and weighing rain gauges.



INTRODUCTION | DIGITAL BAROMETER MSB780X

Solid-state transducer implemented in the barometer offers world class parameters:

- **Accuracy** - it is ideal for the most demanding applications, where exactness and durability are required
- **Stability** - advanced long-term stability and temperature dependence

Hardware design will grant you excellent

- **Durability** - heavy-duty metal enclosure rated IP 66
- **Reliability** - features self-tests and error reporting via SDI-12 and serial lines

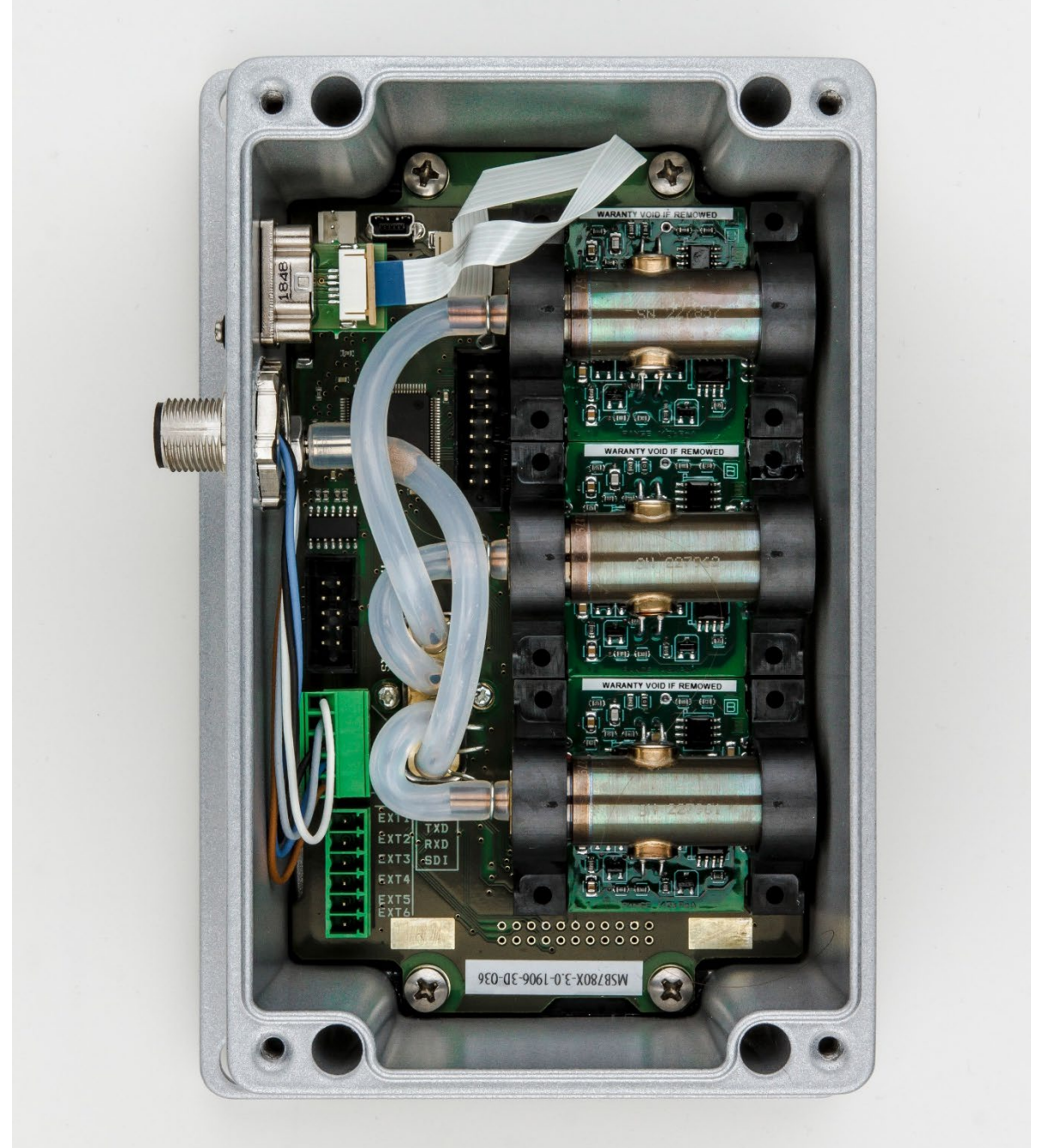


VIBRATING CYLINDER TECHNOLOGY

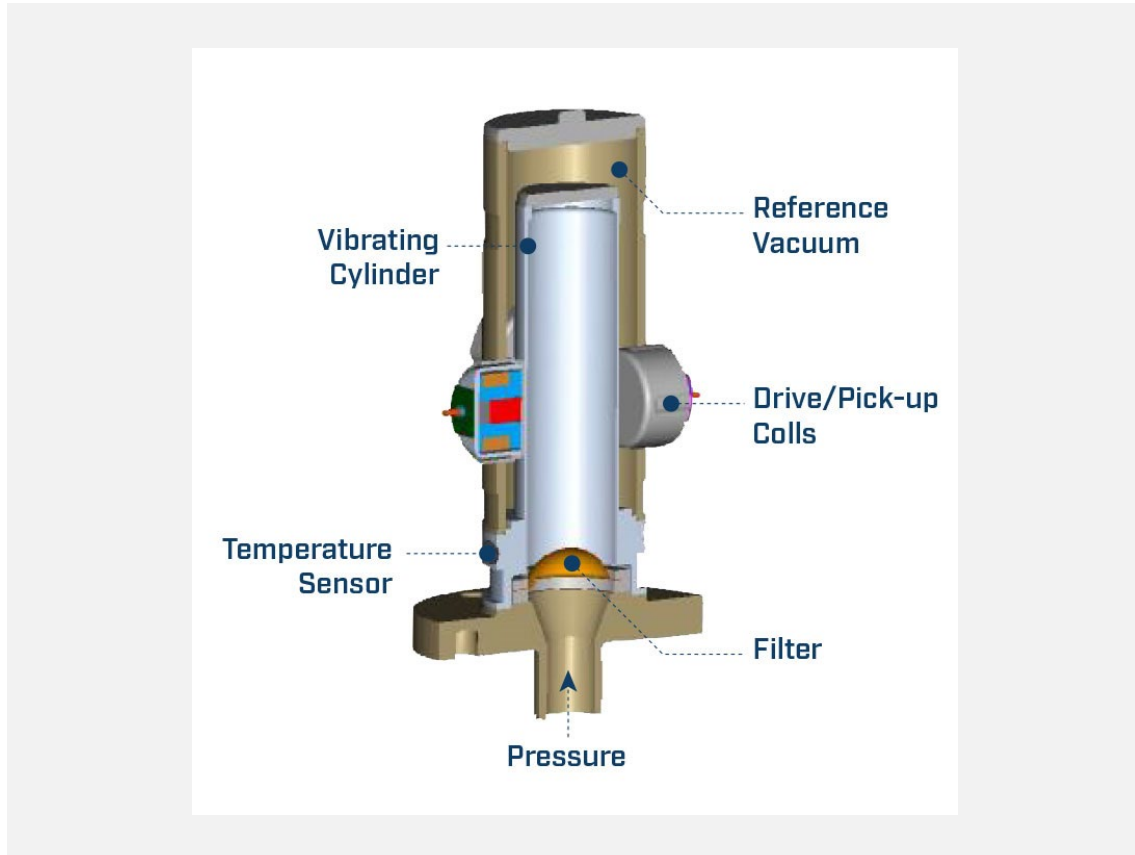
Description

- Oscillating cylinder, where frequency of oscillation is dependent on pressure of the air inside.
- Outside of the vibrating cylinder is evacuated and the inside is connected to the air source.
- Use of high-elasticity and low hysteretic materials results in a highly-stable and high-resolution measurement method.

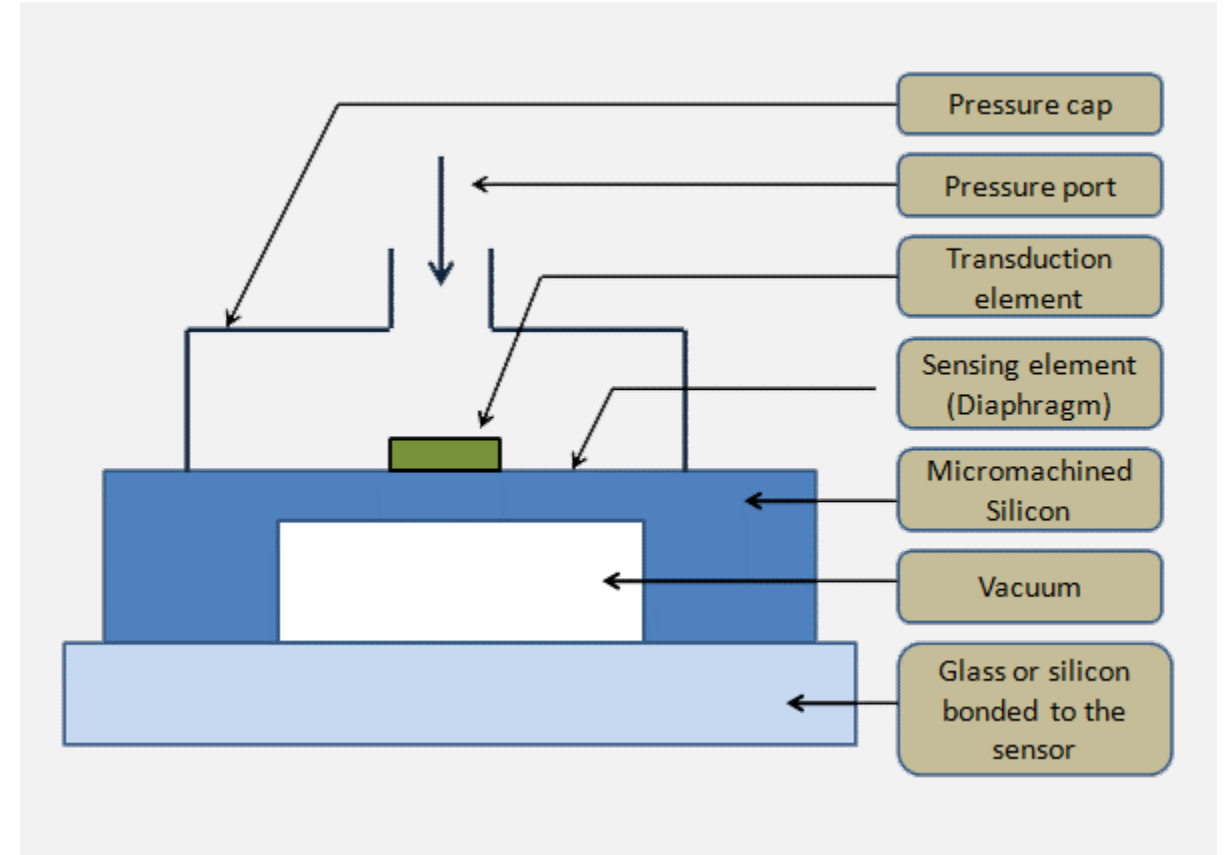
Air must be used as a pressure medium during calibration.



COMPARISON | VIBRATING CYLINDER VS. SILICONE MEMBRANE



Oscillating cylinder, where frequency of oscillation is dependent on pressure of the air inside.



Micromechanical element that uses dimensional changes in its silicone membrane to measure pressure reading.

COMPARISON | VIBRATING CYLINDER VS. SILICONE MEMBRANE

		<i>Vibrating cylinder</i>		<i>Silicone membrane</i>	
	Unit	Class A	Class A+	Class B high range / low range	Class A low range
Pressure range	hPa	103 - 1450	35 - 1310	50 – 1100 / 500 - 1100	500 – 1100
Linearity ^{A)B)}	hPa			±0.20 / ±0.10	±0.05
Hysteresis ^{A)}	hPa	<12 ppm = 0.017 hPa	<10 ppm = 0.013 hPa	±0.08 / ±0.03	±0.03
Repeatability ^{A)}	hPa			±0.08 / ±0.03	±0.03
Calibration uncertainty	hPa			±0.15	±0.07
Accuracy	hPa	N/A - see total accuracy	N/A - see total accuracy	±0.20 @ 20 °C	±0.10 @ 20 °C
Temperature dependence ^{B)}	hPa			±0.30	
Total accuracy	hPa	Better than ±0.145 between -40 & +85 °C	Better than ±0.13 between -55 & +125 °C	±0.45 / ±0.25 between -40 & +60 °C	±0.15 between -40 & +60 °C
Long term stability	hPa	50 ppm in year 1, 20 ppm thereafter	50 ppm in year 1, 20 ppm thereafter	±0.10 (76 ppm/yr)	
Maximum pressure	hPa	4350 W/O derangement	3900 W/O derangement	5000	
	hPa	7250 burst pressure	6500 burst pressure	5000	
Setting time at start up	ms	700 ms	1500 ms max	3000	4000
Response time	ms	Less than 5 ms	Less than 0.5 ms	1000	2000

A) See slides 11, 12, 13.

B) Linearity and temperature dependence do not apply because of the way we do a pressure temperature surface fit.

ADVANTAGES OF VIBRATING CYLINDER

Stable vacuum

All barometers, no matter what element they use, supply atmospheric pressure to one side of the element and the so-called reference vacuum on the other side of the element.

- Reference vacuum – important for long term stability
- In a vibrating cylinder the permeability of the molecules into the vacuum is less than in the silicon membrane element therefore guarantees better long term stability
- Drift close to zero due to all metallic welded construction



ADVANTAGES OF VIBRATING CYLINDER

Thermal hysteresis

SILICONE MEMBRANE – prone to drifts due to external stress (thermal or other) requiring long periods of temperature conditioning.

VS

VIBRATING CYLINDER - is all made of the same material (Ni-Span-C) so does not have the thermal expansion mismatch issues.

Even more accurate pressure reading is achieved by compensating for air humidity.



ADVANTAGES OF VIBRATING CYLINDER

Overload will not destroy the barometer

**SILICONE MEMBRANE - RECALIBRATION
REQUIRED**

Overload can cause deformation or even irreparable damage to the element (can be eliminated by installing preventative measures in the form of other elements).

VS

**VIBRATING CYLINDER - NO RECALIBRATION
REQUIRED**

Overload to 3 times the maximum pressure will cause
NO CHANGE in calibration



ADVANTAGES OF VIBRATING CYLINDER

Low noise

SILICONE MEMBRANE

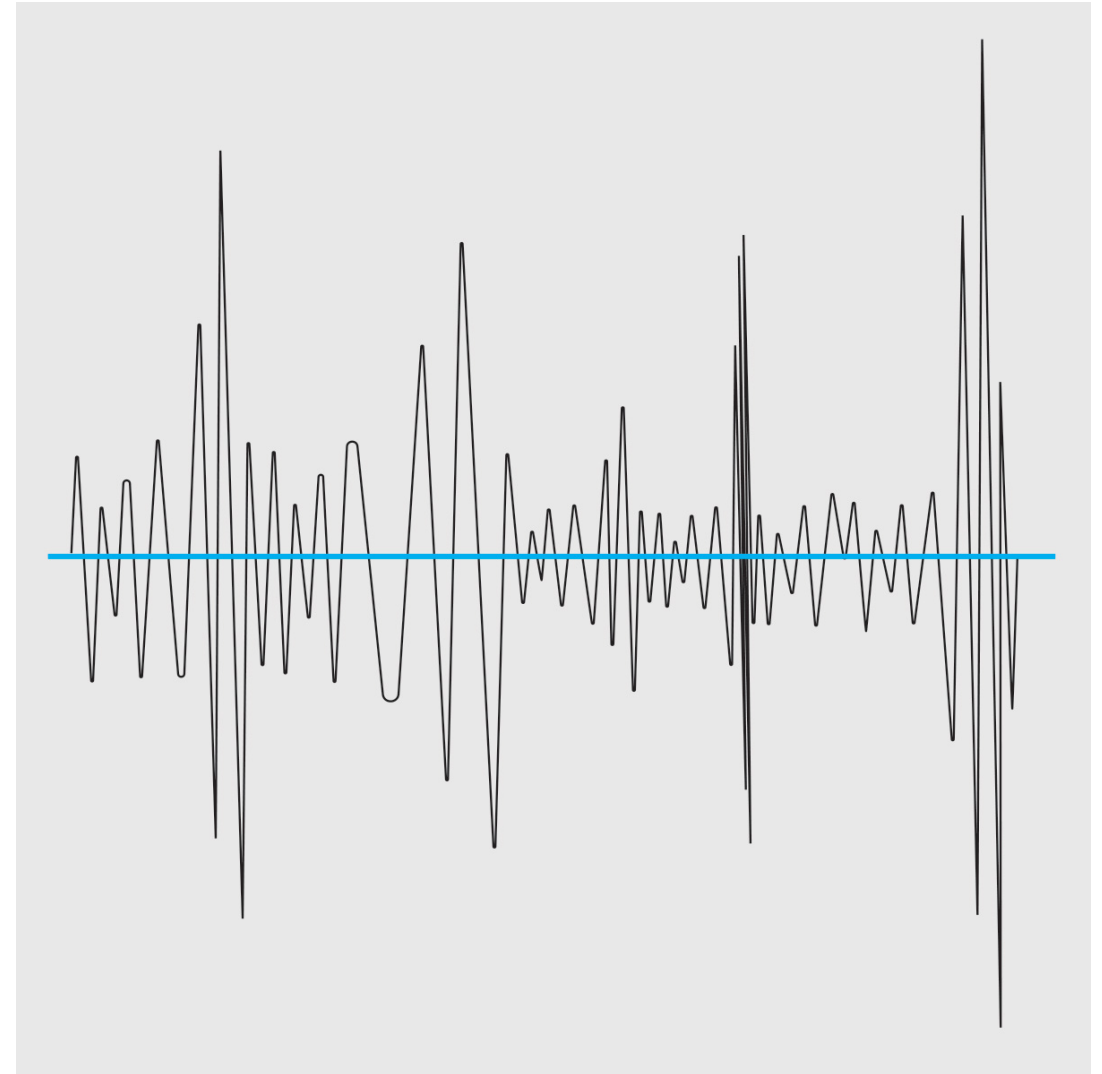
- The pressure is determined by the capacitance

vs

VIBRATING CYLINDER

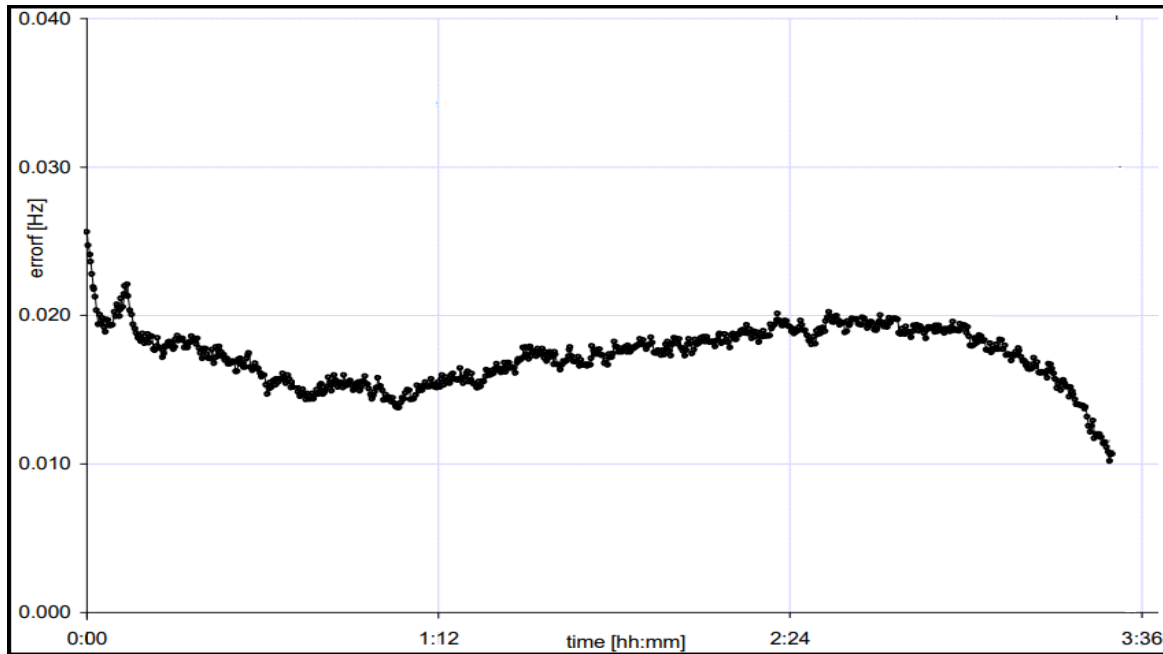
- The pressure is determined by the frequency

Frequency measurement is very accurate with low noise.

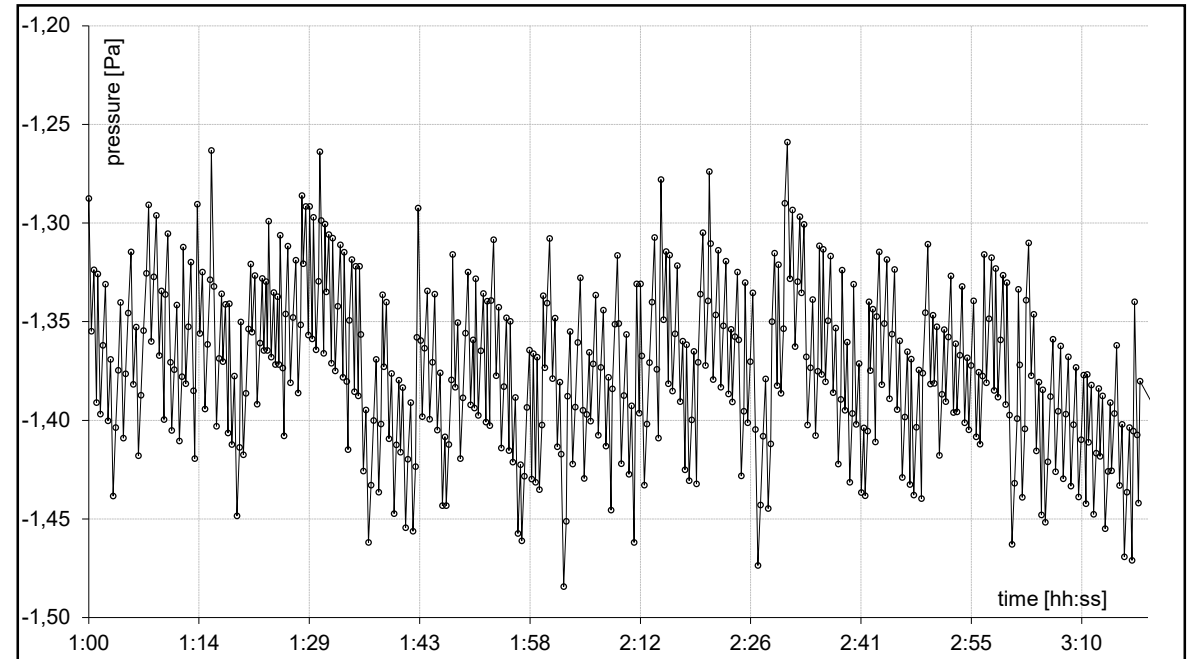


ADVANTAGES OF VIBRATING CYLINDER

Low noise | Data are measured by NMI (National Metrology Institute)



Scattering/Noise of the frequency is about 1mHz (1e-10)

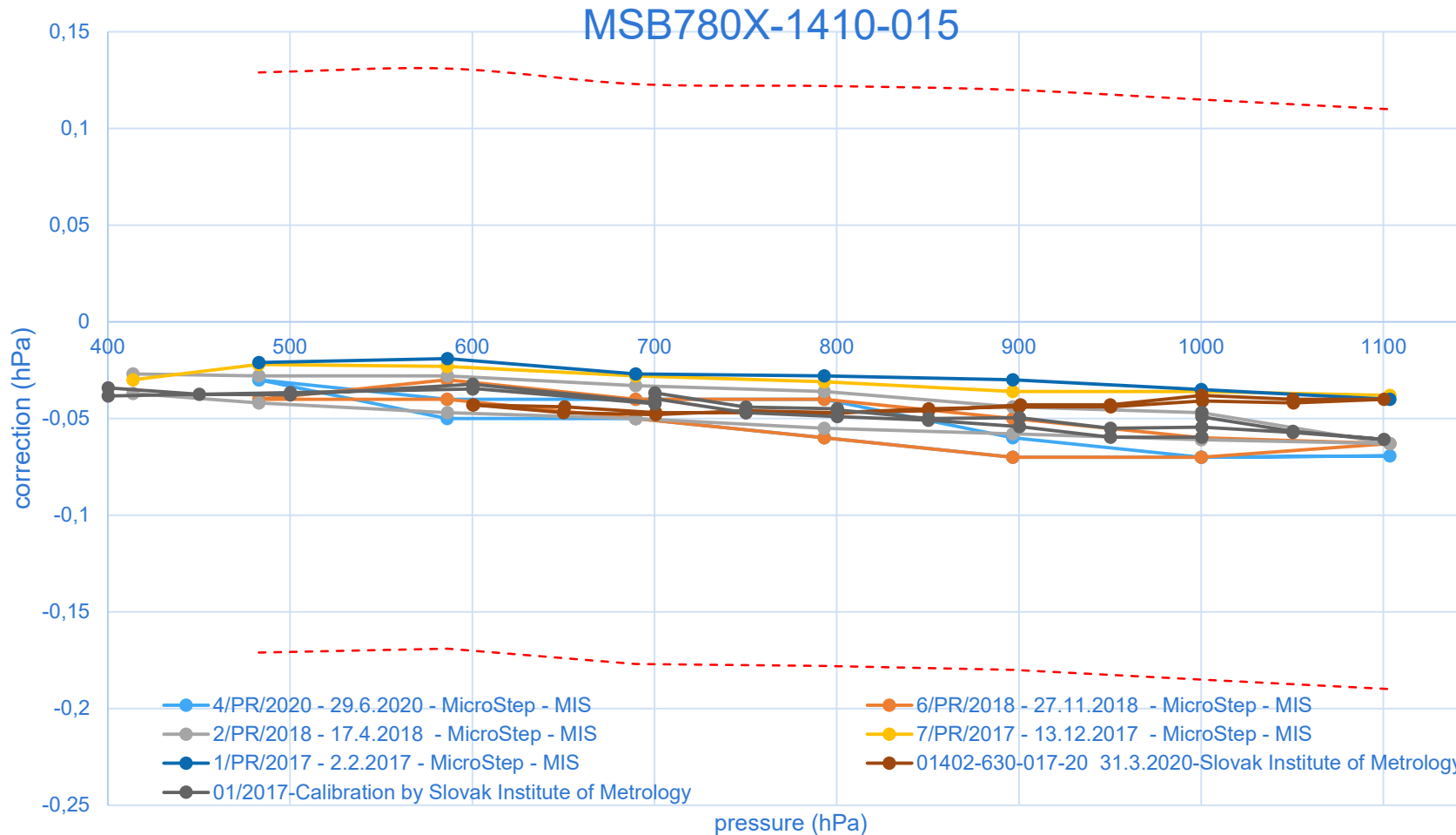


Noise of the pressure is about 0,2 Pa (0,002 hPa)

CALIBRATION OF OUR REFERENCE STANDARD IN THE YEARS FROM 2017 - 2020



Slovak Institute of Metrology



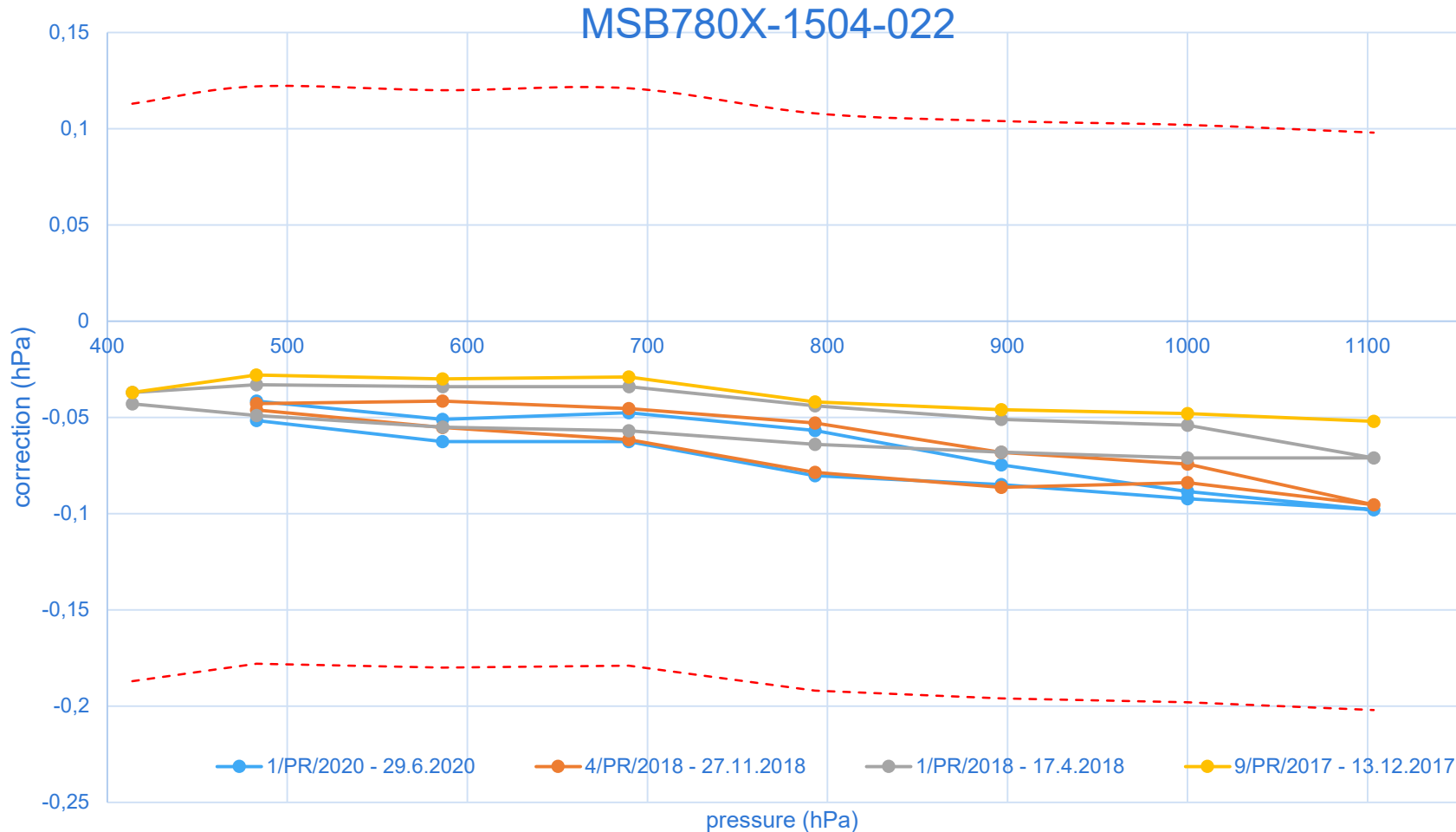
Calibration of our reference standard in the years from 2017 to 2020. Calibrations were performed by our accredited laboratory and the Slovak Institute of Metrology. A piston pressure gauge was used as a standard.

As can be seen in both cases, even in 3 years, the declared long-term stability was not exceeded in one year (0.05 hPa).

THE RESULTS OF THE CALIBRATION OF THE RANDOMLY SELECTED BAROMETERS



Slovak Institute of Metrology

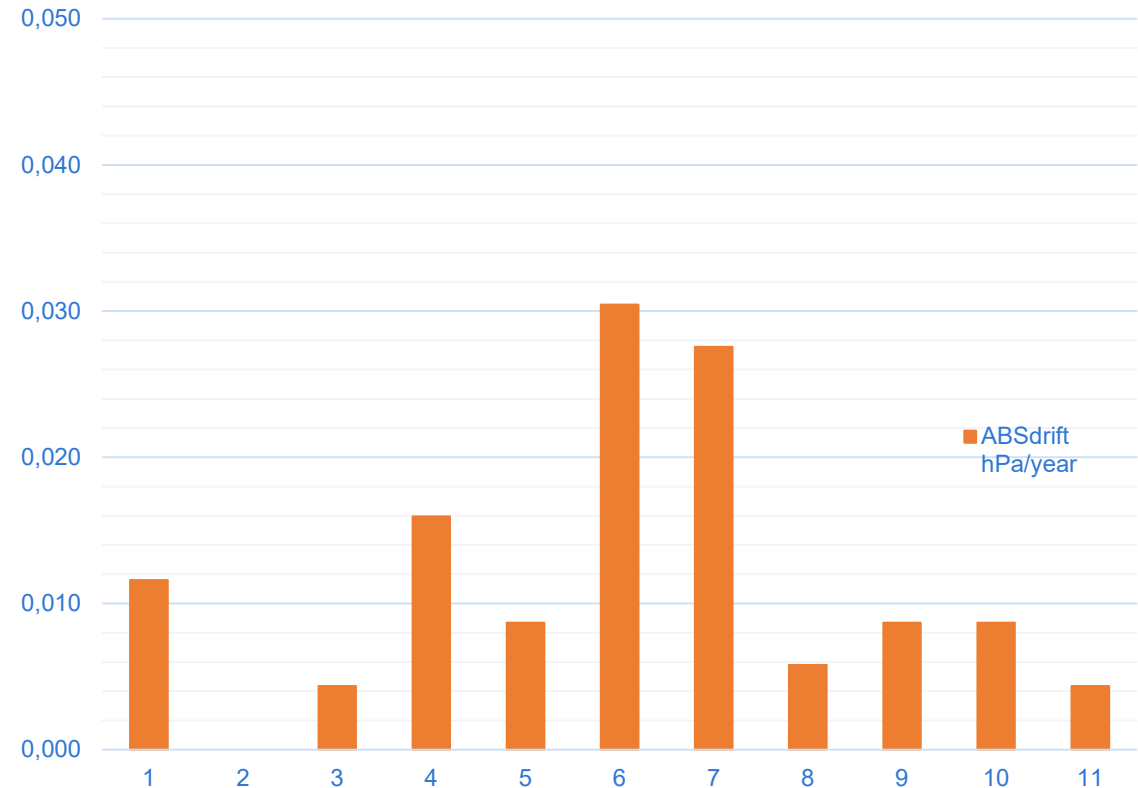


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As can be seen in both cases, even in 3 years, the declared long-term stability was not exceeded in one year (0.05 hPa).

EVALUATION OF LONG-TERM STABILITY ON 11 PIECES OF ESTERLINE 7800 PRESSURE ELEMENTS

No.	S/N	Number of tests	Testing time (year)	ABSdrift hPa/year
1	616549	126	4,3	0,012
2	611104	111	3,17	0,000
3	910117	13	0,75	0,004
4	811835	42	3,97	0,016
5	624700	17	2,23	0,009
6	624701	17	2,23	0,030
7	624702	16	2,23	0,028
8	624703	18	2,2	0,006
9	624704	16	2,3	0,009
10	624705	33	0,57	0,009
11	910117	13	0,75	0,004



During the whole testing period, none of the elements drifted more than 0.5 hPa / year

3 SILICONE ELEMENTS VS 1 VIBRATING CYLINDER ELEMENT

3 elements for 1 barometer were put into practice due to mutual control by the barometer.

3 SILICONE MEMBRANE

- Mutual control by a barometer
- Error / drift of one element was able to compensate by other elements.

1 VIBRATING CYLINDER

- None of the tested elements exceeded the drift values during the testing (slide 12)
- A barometer with one vibrating element can meet the requirements (slide 11)
- the difference between 3-chamber and 1-chamber is negligible (slide 11 vs 10)

It is not necessary to require three vibrating cylinder elements.

SUMMARY

MSB780 and MSB780X offer barometer with a premium quality

Quality stands for

- ✓ **Accuracy**
- ✓ **Reliability**
- ✓ **Stability**
- ✓ **Durability**

Usable in the harshest environments while still customizable.

Top class among
barometers



CONTACT US | HEAD OFFICE



info@microstep-mis.com

www.microstep-mis.com

MicroStep-MIS
Čavojského 1
841 04 Bratislava 4
Slovak Republic

CONTACT US | OFFICES WORLDWIDE

